ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 15 No. 4
September 2015
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

VEGETABLE PRODUCTION, CONSUMPTION AND ITS CONTRIBUTION TO DIETS ALONG THE URBAN – RURAL CONTINUUM IN NORTHERN GHANA

Chagomoka T*[1], Drescher A[1], Glaser R[1], Marschner B[2], Schlesinger J[1], and G Nyandoro[3]

Takemore Chagomoka

Corresponding author's e-mail: takemore.chagomoka@geographie.uni-freiburg.de

[1]Institute of Environmental Social Sciences and Geography, University of Freiburg Werthmannstr. 4, 79085 Freiburg, GERMANY

[2]Institute of Geography, Ruhr-University Bochum, Universitätsstr. 150, 44803, Bochum, GERMANY

[3]Community Medicine Department, College of Health Sciences, University of Zimbabwe, P.O Box A 178 Avondale, Harare, ZIMBABWE

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 15 No. 4 September 2015
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

ABSTRACT

Malnutrition continues to be a problem, with sub-Saharan Africa affected the worst. Women and children are at the pinnacle of this problem. The perpetual scourge of malnutrition in urban and periurban settings, coupled with levels of vegetable consumption below the recommended amounts, are a major problem in most African countries including West African cities. A household survey was conducted between November and December 2013 (dry season) in and around Tamale, Ghana as part of an urban food system analysis, to understand vegetable production and consumption and its contribution to household diets and income along the urban – rural continuum. Data collection was guided by a transect approach. A total of 240 households participated in the survey, with 62% males and 38% females. Additionally, 186 women of reproductive age (15 – 49 years) staying in the sampled households contributed to the computing of household dietary diversity through Women's Dietary Diversity Scores (WDDS). Most vegetables produced were for subsistence use, considering that most households sold less than 50% of the crops and consumed the rest. Vegetable production varied significantly along the urban - rural continuum, with more households in rural areas producing all the requirements of their vegetables compared to urban and periurban areas. Nevertheless, the households in the rural areas (16%) had the lowest dietary diversity (≤ 3 WDDS) compared to urban areas (13%) and periurban areas (5%). The study showed low consumption of vegetables (especially the dark green vegetables) mostly in the rural area and limited diversity of vegetables, especially vitamin A rich vegetables and tubers, with only three vegetables (carrots, red pepper and sweet potato) consumed. There was evidence of more inclination toward staple crops compared to vegetables along the urban – rural continuum for both production and consumption, clearly shown in crops grown and food groups mostly consumed (cereals and tubers rather than dark green vegetables). There was overall low consumption of dark green leafy vegetables, such as amaranth, with only 26% reported to have consumed them during the reported period compared to food groups like cereals (98%). This study confirms the dual purpose of vegetables in complementing dishes (balanced diets) with much needed micronutrients and helping households along the urban – rural continuum to generate income.

Key words: Vegetables, dietary diversity, food groups, urban – rural continuum, Northern Ghana

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 15 No. 4 September 2015 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

INTRODUCTION

Malnutrition is rampant and continues to be a global challenge, contributing to approximately one third of the nearly eight million deaths of children under five years of age worldwide [1]. At the same time, about 500 million people still suffer from protein-energy malnutrition, over 1.6 billion suffer from iron deficiency and over 200 million from vitamin A insufficiency [2,3]. These problems are more likely to manifest in cities, mostly in the developing world [4]. There is growing evidence that cities in the developing world will face a rapid influx of people due to rural-urban migration and the natural population increase [5]. The number of African urban dwellers has been projected to rise from 11.3 % in 2010 to a 20.2 % by 2050 [6], further perpetuating urban food and nutrition demands.

Rapid growth of cities has posed a lot of challenges to urban dwellers including unemployment, food insecurity and malnutrition [7]. Although it has been believed over the years that urban households are better placed than their rural mates in terms of infrastructure (urban bias) [8], recent trends show more evidence of rising urban poverty [9]. In the midst of growing cities, looming food shortages and sometimes unfortunate eating habits, urban populations are likely to face a double burden of malnutrition amongst the urban poor and obesity amongst the so called middle class [4].

Vegetable production and consumption have the potential to create employment and generate income in the developing world [10], while at the same time providing much needed micronutrients for the body and antioxidants and phytochemicals that may protect people against non-communicable diseases [11]. Some protective properties against ulcers induced experimentally, have been found in African eggplant, making it a cheap and natural anti-ulcer remedy [12]. Nevertheless, the consumption of vegetables globally remains below the expected minimum of 400g of fruit and vegetables per day (excluding potatoes and other starchy tubers), with sub-Saharan Africa lagging behind [13]. The consumption of vegetables can be improved by incorporating vegetables in tasty and attractive meals as demonstrated in the work of Chagomoka *et al.* [14], but developing recipes including nutritious vegetables has been a neglected research area [15]. The production of vegetables in and around cities, especially in developing countries has been associated with risks ranging from use of waste water to unsafe use of pesticides [16–19]. Nevertheless, urban agriculture, which often takes the form of vegetable production, has been argued to be part of sustainable urban development [20]. Vegetable production has been associated with diverse gender issues, for example, often times the marketing of vegetables and production of less profitable crops is dominated by women while laborious tasks and production of high cash crops are taken over by men [21].

Studies on production and consumption of vegetables have been done in sub-Saharan Africa; nevertheless, there is lack of knowledge of the changes in the contribution of vegetables to diets along the urban – rural continuum. Using data of a larger study conducted between November and December 2013 that had the objective to understand the socio-spatial dynamics of household food and nutrition insecurity in sub-Saharan Africa, this paper addresses vegetable production, consumption and contribution to diets

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 15 No. 4 September 2015 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

in Tamale (Ghana). The overall aim was to investigate the role played by urban and periurban agriculture.

MATERIALS AND METHODS

Mixed methods from natural and social science were used in this study to strengthen the scientific rigor. A structured questionnaire was used to collect crop production, consumption and marketing data between November and December 2013. Individual dietary diversity scores (IDDS), targeting women of reproductive age (15 – 49 years), referred to here as the Women's Dietary Diversity Score (WDDS) was used to assess the dietary diversity at the household level and reflect the presence of vegetables in household diets across the urban – rural continuum.

Description of study area

The study covered seven districts[1] in Ghana´s Northern Region, located in and around Tamale. The Tamale Metropolitan Assembly (TMA) is the capital town and administrative headquarters of the Northern Region (Figure 1). It is within the savannah climate region of West Africa, with an altitude of 180 meters above sea level. The soils are mostly Savanna Ochrosols that are poor in organic matter, but loamy, well-drained and porous. The climate is characterised by two main seasons, one rainy season from April to October with rainfalls of more than 1000 mm and a dry season from November to March. As a result, the city is poorly endowed with surface water, with only a few seasonal streams that dry up during the dry season. Tamale Metropolitan Area population was estimated to be 370,000 as of the year 2010 [22]. West Africa has been experiencing intensive urbanization for many years. The urbanization process in Africa is taking place in the absence of significant industrial expansion and mostly driven by rural-urban migration.

[1] Central Gonja, East Gonja, Mion, Sagnarigu, Savelugu-Nanton, Tamale Metropolitan and Tolon

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 15 No. 4 September 2015
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

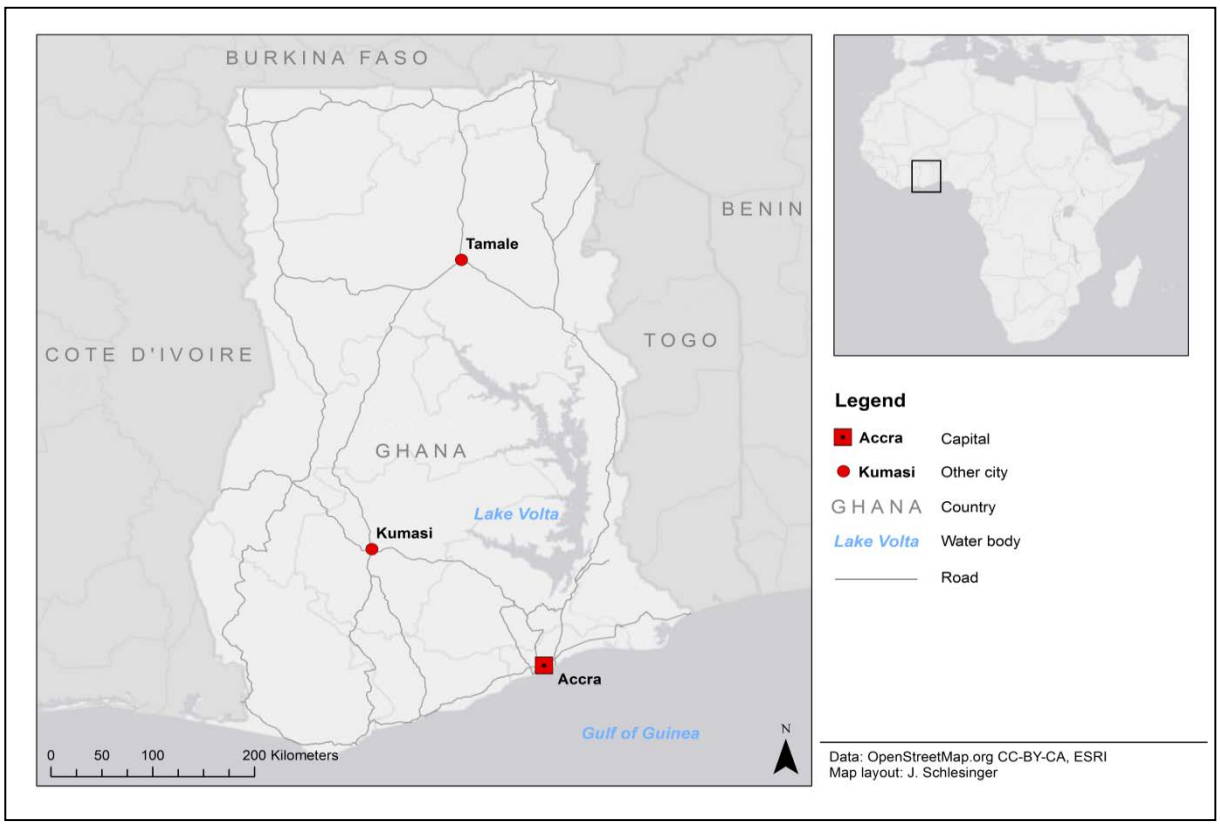

Figure 1: Location map of Tamale in Northern Region of Ghana

Study Design and Sampling Approach

A transect approach was used to guide data collection. This approach has been used in many studies, some of them analysing vegetation, vegetable production and use of natural resources [16,23]. Four transects, 2km wide and 70km long were laid out radially, heading towards North, East, South, and West, respectively, and four compass directions were chosen (quasi-random sampling) with Tamale central market being the centre (Figure 2). Each transect was divided into three zones (urban, periurban and rural), based on the reviewed literature on the extent of urban, periurban and rural areas in West Africa [17, 24, 25]. The identification of the periurban areas was strongly supported by the work of Iaqiunta and Drescher [26]. The advantage of this approach is the probability of including households that may be excluded in most sampling approaches, which usually follow the linear settlement pattern of households along developments like major roads. The weakness of this approach is the concentration along the transects and not elsewhere.

In this study, the first zone (urban) was within 10 km and the second zone (periurban) between 10 to 40 km and the third zone (rural) between 40 to 70 km distance from the city centre. All households along the transects were digitised and randomly selected using Geographic Information Systems (GIS). All three zones were repeated on all four transects across the city (Figure 2). Twenty households per zone were randomly selected, thus 3 zones by distance x 4 sections of town x 20 households = 240. This translated to 80 households in each zone (urban, periurban and rural). The coordinates of the randomly selected households were transferred to a Global Positioning System (GPS) to help in

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 15 No. 4
September 2015
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

locating and tracking the randomly selected households along the transects. Additionally, 186 women of reproductive age (15 – 49 years) staying in the sampled households contributed to the computing of WDDS.

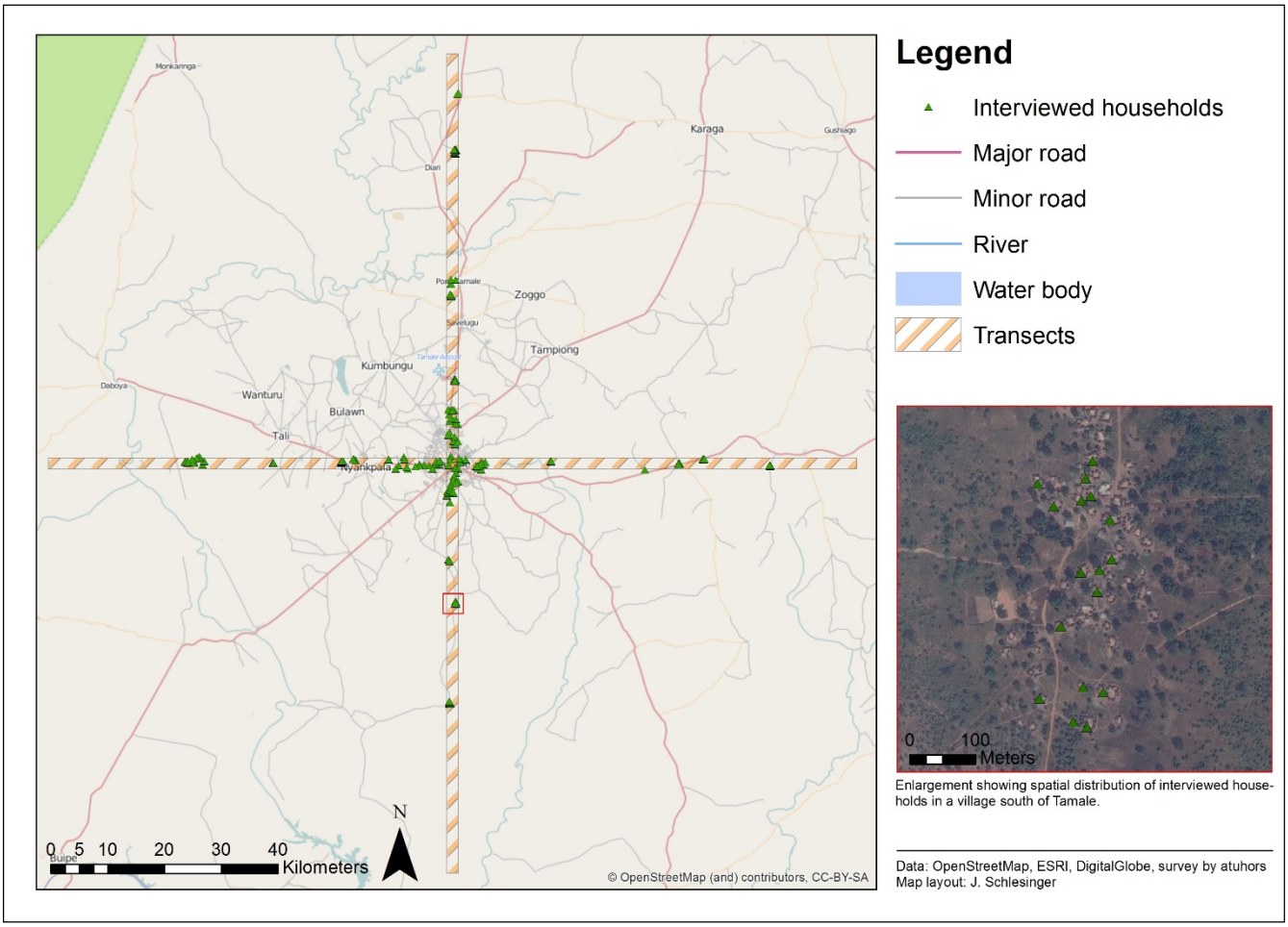

Figure 2: Transect sampling

Data Collection

Household face-to-face interviews targeting household heads and women of reproductive age using structured questionnaires were used to collect data on crop production, consumption, marketing, income and household dietary diversity. The details of these are below:

Assessment of household dietary diversity

Dietary diversity was assessed through WDDS, which reflect nutrient adequacy and are a proxy of household nutrition [27]. The study targeted women of reproductive age to assess dietary diversity. All ingredients used in preparing different dishes consumed by women were noted to assist in identifying and tracking where vegetables were consumed. Based on the food items consumed in the past 24 hours, respondents were assigned the number of food groups they consumed ranging from 0 to 9. An increase in number of food groups or WDDS is related to increased dietary diversity. Women were classified into three groups based on the distribution in the sample; ≤ 3 food groups as lowest

dietary diversity, 4 – 5 food groups as medium dietary diversity and ≥ 6 as highest dietary diversity.

Data Management and Analysis
Epidata 9 was used for data entry before data were exported to SPSS 16 and STATA 12 for further cleaning and analysis. For continuous outcomes, statistical significance was assessed using Multivariate Analysis and posthoc to control for confounding factors. For categorical and dichotomous outcomes, chi-square tests were used to assess statistical significance. Continuous data were checked for normality and the analysis of variance was used to assess the independent contribution of vegetables to dietary diversity.

Ethical issues
In each community, study objectives and purpose were clearly conveyed to community leaders and respondents. Permission was sought before data collection from local leaders and respondents. Respondents had the opportunity to stop participating in the research at any time of their choice during interviews and none opted out of the interviews.

RESULTS

The results represent vegetable production, consumption, and marketing and their contribution to diets along the urban – rural continuum as guided by the transect approach. The authors are aware of other main vegetable production sites in and around Tamale including Gumbihini new dam area, Gumbihini old dam area, former Gumbihini Volta River Authority (VRA) area, Sangani area, Zagyuri, Golinga irrigation, Savelugu irrigation sites and Botanga irrigation among others, which are not part of the transects and thus not reflected in this paper.

Vegetable production along the urban – rural continuum
The following vegetables were the most grown along the urban – rural continuum in and around Tamale; okra *(Abelmoschus esculentus)*, pepper *(Capsicum spp)*, roselle *(Hibiscus sabdariffa)*, jute mallow *(Corchorus olitorius)*, tomato *(Solanum lycopersicum)*, egusi *(Citrullus colocynthis)*, amaranth *(Amaranthus spp.)*, onion *(Allium cepa*) and garden egg *(Solanum melongena)* (Table 1). Most vegetables were grown in rain-fed cultivation systems in the months of May to October. During the dry season (November to April), however, smaller areas were cultivated with dug outs, shallow wells and waste water being the main sources of water. Okra, pepper and roselle were the most commonly produced vegetables. They were mainly cultivated for subsistence, as most households sold less than 50% of the crops and consumed the rest (Table 1).

There was great variability in types of vegetables produced from one ethnic group to another. For example egusi was a common crop amongst the Gunja ethnic group in the East and Central Gunja districts while roselle and okra were more common with the Dagomba ethnic group. One of the possible explanations could be the difference in cultural dishes and tastes amongst the ethnic groups influencing the choice of vegetable crops produced. For example, okra and *Tuo Zaafi* or thick porridge is a staple dish amongst the Dagomba ethnic group. Tomatoes, in contrast, were scarcely produced along the urban – rural continuum (only 6% of the interviewed households were producing

tomatoes), with most tomatoes on the markets reported to be coming from elsewhere as far as Ouagadougou, Burkina Faso. Nevertheless, tomatoes and okra were the most consumed vegetables, clearly portraying Tamale as a tomato-consuming area rather than a major production area.

More households in the rural areas produced vegetables to meet all the requirements of their households compared to urban and periurban areas (Figure 3). Nevertheless, the households in the rural areas (16%) had the lowest dietary diversity (≤ 3 WDDS) compared to urban areas (13%) and periurban areas (5%) (Table 2). On the other hand, there was a greater proportion of households producing staple crops to meet all the requirements of their households compared to those producing vegetables (Figure 3 and 4). Amaranth, jute mallow, tomato and egusi were on the top of being grown as cash crops compared to other crops, with many households growing them and selling more than 50% of the crop (Table 1).

There was a statistically significant association between the position along the urban - rural continuum and the level of vegetable production (Pearson chi-square value of 39.4, P<0.001). There was also a statistically significant association between the position along the urban – rural continuum and the level of staple crop production (Pearson chi-square value of 113.4, P<0.001). Nevertheless, the results reveal that vegetable production in and around Tamale has no statistically significant contribution to the changes in WDDS, because at all vegetable production levels, the mean WDDS is not significantly different compared to the non-vegetable producing level (p=1.000).

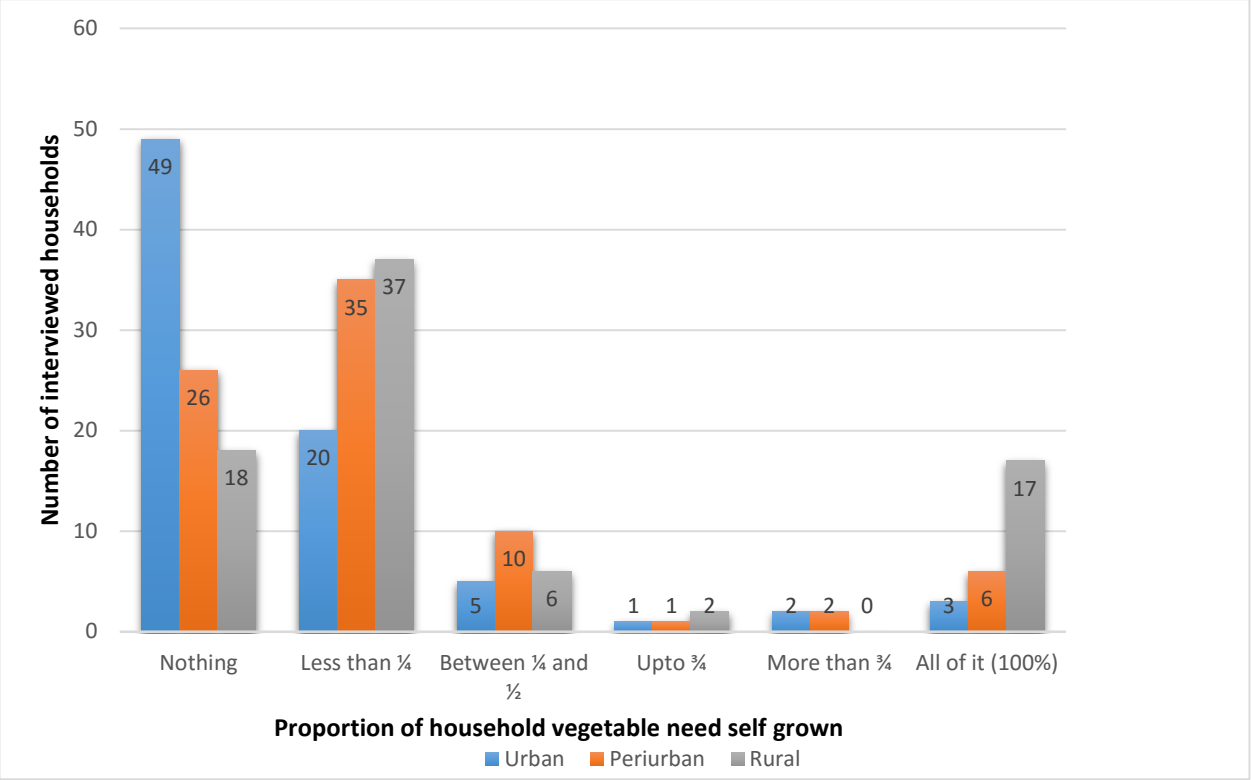

Figure 3: Vegetable production along the urban - rural continuum

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 15 No. 4 September 2015
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

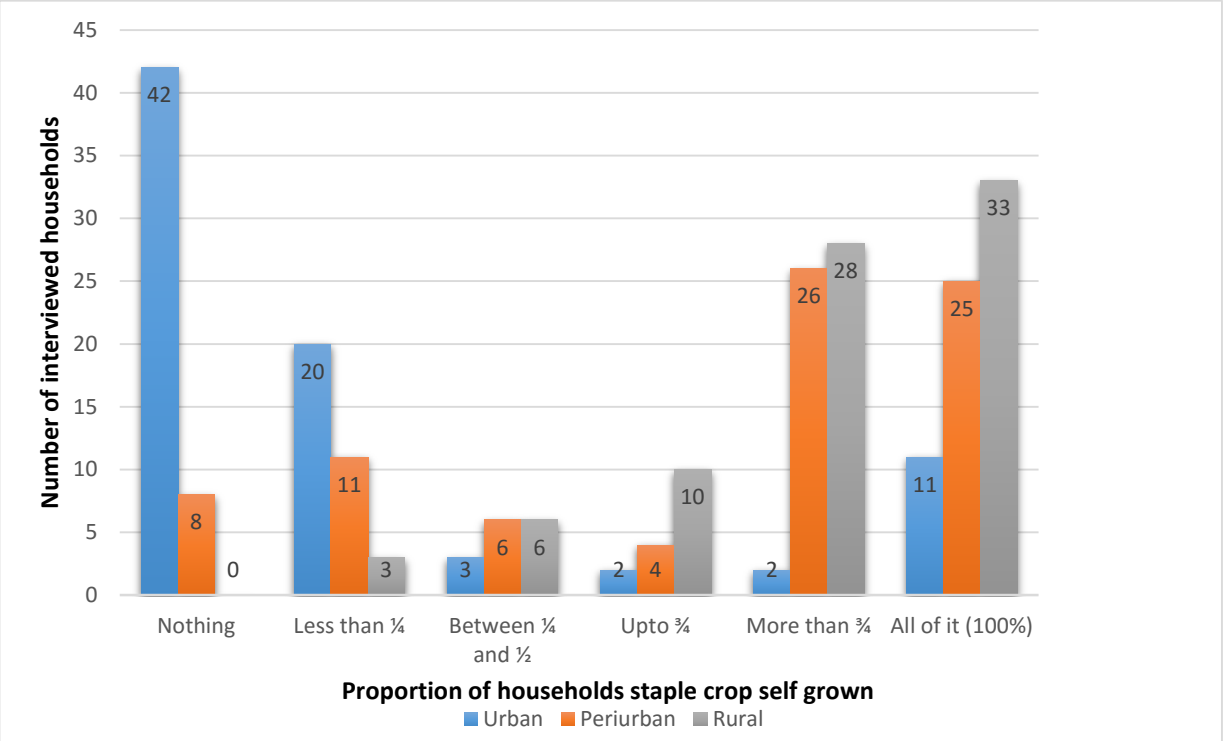

Figure 4: Staple crop production along the urban - rural continuum.

Vegetable consumption along the urban – rural continuum

The results reflected the presence of vegetables consumed by surveyed households along the urban – rural continuum between November and December 2013 (dry season), as part of their dishes. (Table 2). Nevertheless, at a closer look, there was a mixed picture along the urban – rural continuum of consumption of dishes including vegetables; with rural households consuming more vitamin A-rich vegetables and tubers (90%); urban households consuming more dark green leafy vegetables (29%) and periurban households consuming more of other vegetables (96%). There was overall low consumption of dark green leafy vegetables, such as amaranth, with only 26% reported to have consumed them during the reported period compared to food groups like fish and seafood (88%) and cereals (98%). More households in the urban setting were consuming more oil and fats (27%), which can be described as an "oily diet" in the cities compared to periurban and rural. In some households, the diversity was limited to dry okra. Commonly consumed vegetables based on different food groups are shown in Table 3, with only three vegetables (carrots, red pepper and sweet potato) under vitamin A rich vegetables and tubers.

DISCUSSION

This study revealed that okra, pepper and roselle were the most produced vegetables along the urban - rural continuum in and around Tamale. These crops were mainly cultivated for subsistence use. The reason could be that crops like okra form a critical part of traditional dishes in and around Tamale with over 45% of women of reproductive

age eating it during the reported period. Okra is mostly used in soups, both as dry and fresh okra. Okra and other crops like jute mallow are produced mainly for subsistence because they are perceived as less profitable crops as also reported by Kessler *et al.* [21]. Production of vegetables and fruits has been seen as a critical strategy to improve consumption as recently revealed in the work of Kabunga *et al.* in Uganda [28].

There was a greater proportion of households producing staple crops to meet all the requirements of their households compared to those producing vegetables (Figure 3 and 4). This could be due to the subsistence nature of staple crops and food consumption habits in these regions, where there was more presence of staple crops like maize, cassava, rice and yams in most consumed dishes usually accompanied by small quantities of vegetables (Table 2). This was also reflected in consumed dishes, with a limited variety of vegetables. Nevertheless, vegetable production has been reported to have great potential to generate extra income, which can also be used to buy household food demands while at the same time providing much needed micronutrients [10,11,29].

There was low consumption of dark green leafy vegetables, such as amaranth, compared to food groups like fish and seafood (Table 2). Dark green vegetables have higher levels of vitamin A than other vegetables [27], as also reflected in the recent work of Kamga *et al.* [29] in Cameroon. Vitamin A insufficiency is a worrying global problem [3]; however, production and consumption of nutrient-dense vegetables can be a cheap and easy way for the urban and rural poor to increase micronutrients in their diets [30].

The study showed low consumption of vegetables (especially the dark green vegetables) and limited diversity of vegetables, especially vitamin A rich vegetables and tubers with only three vegetables (carrots, red pepper and sweet potato) consumed (Table 2 and 3). In some households the diversity was limited to dry okra often accompanied by *Tuo Zaafi* (thick porridge usually made from maize or sorghum). Based on previous studies, it is more beneficial for households to diversify their vegetable crops as a strategy to enhance income and nutrient adequacy. The work of Kamga *et al.* [29] reveals that nutrient content of various vegetables can vary between accessions, thus critical to diversity within accessions of the same crop (for examples AB2 and DB3 accessions of eggplant - *Solanum aethiopicum*) and not only between various crops (for example, jute mallow and African eggplant). On the other hand, studies have classified some vegetables as more profitable than others including the work of Kessler *et al.* [21] .

The results reveal varying food habits along the urban – rural continuum, for example, urban households (27%) were consuming more food under the oil and fats group *(which can be referred to as oily diets)* compared to periurban (18%) and rural (21%) households (Table 2). The same trend was also under the red palm products with 7% of urban households consuming them compared to 4% of households in the periurban area and 3% in the rural area (Table 2). On the other hand, more households in rural areas (50%) were consuming food under white roots and tubers *(which can be referred to as starch-based diets)* compared to urban households (31%) and periurban households (29%).

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 15 No. 4 September 2015 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

CONCLUSIONS

Vegetable production varied significantly along the urban - rural continuum (Pearson chi-square value of 39.4, $P<0.001$), with more households in rural areas producing all the requirements of their vegetables compared to urban and periurban areas. Nevertheless, households in urban areas had the highest dietary diversity, including the highest dark green leafy vegetable consumption, which may be due to accessibility to various sources of food suppliers ranging from shops, and fruit and vegetable markets.

There was evidence of more inclination towards staple crops compared to vegetables along the urban – rural continuum for both production and consumption, clearly shown in crops grown (more households producing all the requirements of their staple crops than vegetables) and food groups mostly consumed (more cereals and tubers than vegetables).

The study also showed a limited diversity in both vegetables produced and consumed (especially the dark green vegetables) mostly in the rural area, strongly supporting the notion confirmed in Uganda that increased production of vegetables may eventually lead to improved consumption [28]. The production and consumption of nutrient-dense vegetables can be a cheap and easy way for urban and rural poor to increase micronutrients in their diets.

This study confirms the potential dual purpose of vegetables of complementing dishes (balanced diets) with much needed micronutrients and also helping to generate income to households along the urban – rural continuum.

ACKNOWLEDGEMENTS

This study is part of the first author's Ph.D. work, done under the project UrbanFood^{Plus}, financially supported by Federal Ministry of Education and Research (BMBF). We thank the village chiefs and all the authorities in the surveyed area for their cooperation during the data collection. The authors wish to thank all those who participated in the survey, especially women. We thank the field assistants, student assistants, and data entry clerks for their dedication during this study. The article processing charge was funded by the German Research Foundation (DFG) and the Albert Ludwigs University Freiburg in the funding programme Open Access Publishing.

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 15 No. 4 September 2015 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Table 1: Vegetable production and marketing along the urban – rural continuum

Location	Urban		Periurban		Rural	
	Respondents growing the crop (%)	Sold >50% (%)	Respondents growing the crop (%)	Sold >50% (%)	Respondents growing the crop (%)	Sold >50% (%)
Okra	21	29	59	17	71	18
Pepper	13	70	55	39	64	24
Roselle	26	29	54	12	55	9
Jute Mallow	15	33	10	0	8	0
Tomato	5	25	5	50	9	43
Egusi	0	0	9	43	20	38
Amaranth	15	33	8	17	6	0
Onion	1	100	0	0	0	0
Garden egg	0	0	1	100	1	100

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 15 No. 4 September 2015 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Table 2: Percentage of households consuming various food groups and Women's Dietary Diversity Score along the continuum

Location		Urban % (n)	Periurban % (n)	Rural % (n)	Overall % (n)
N		100 (68)	100 (56)	100 (62)	100 (186)
Food groups	Cereals	99 (67)	100 (56)	97 (60)	98 (183)
	White roots and tubers	31 (21)	29 (16)	50 (31)	37 (68)
	Vitamin A rich vegetables and tubers	87 (59)	86 (48)	90 (56)	88 (163)
	Dark green leafy vegetables	29 (20)	25 (14)	23 (14)	26 (48)
	Other vegetables	93 (63)	96 (54)	84 (52)	91 (169)
	Vitamin A rich fruits	56 (38)	86 (48)	70 (49)	73 (135)
	Other fruits	12 (8)	4 (2)	0 (0)	16 (10)
	Organ meat	0 (0)	0 (0)	0 (0)	0 (0)
	Flesh meat	21 (14)	14 (8)	8 (5)	15 (27)
	Eggs	3 (2)	4 (2)	0 (0)	2 (4)
	Fish and sea food	84 (57)	89 (50)	90 (56)	88 (163)
	Legumes, nuts and seeds	50 (34)	61 (34)	58 (36)	56 (104)
	Milk and milk products	3 (2)	0 (0)	3 (2)	2 (4)
	Oil and fats	27 (18)	18 (10)	21 (13)	22 (41)
	Sweets	62 (42)	64 (36)	68 (42)	65 (120)
	Spices, condiments, beverages	99 (67)	100 (56)	100 (62)	100 (185)
	Red Palm products	7 (5)	4 (2)	3 (2)	5 (9)
WDDS ≤ 3		13 (9)	5 (3)	16 (10)	12 (22)

Table 3: Specific vegetables consumed from different food groups in Tamale

Food Group	Specific vegetables
Vitamin A rich vegetables and tubers	Carrots, red pepper, sweet potato
Dark green leafy vegetables	Amaranth, roselle, jute mallow, okra leaves, onion leaves
Other vegetables	Cabbage, garlic, okra, onion, tomato, eggplant, lettuce

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 15 No. 4 September 2015 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

REFERENCES

1. **WHO.** Guideline: Updates on the management of severe acute malnutrition in infants and children. Geneva, 2013.

2. **WHO.** Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia. Geneva, Switzerland: WHO, 2008.

3. **WHO.** Global prevalence of vitamin A deficiency in populations at risk 1995-2005: WHO global database on vitamin A deficiency. Geneva, Switzerland: World Health Organization (WHO), 2009.

4. **UN Standing Committee on Nutrition.** Tackling the double burden of malnutrition: A Global Agenda. SCN News. United Kingdom: Lavenham Press, 2006.

5. **Prain G, Lee-Smith D and N Karanja** (Eds). African urban harvest: Agriculture in the cities of Cameroon, Kenya and Uganda. New York, Ottawa, Lima, Peru: Springer; International Development Research Centre; International Potato Center, 2010; 3.

6. **UN-HABITAT.** The State of African Cities 2014: Re-imagining sustainable urban transitions. Nairobi, Kenya: United Nations Human Settlements Programme, 2014; 23.

7. **UNFPA.** The State of the World Population. Unleashing the potential of urban growth. New York: United Nations Population Fund, 2007: 1-108.

8. **Bates R** Markets and states in tropical Africa. Berkeley, CA, USA: University of California Press, 1981.

9. **Ahmed AU, Hill RV, Smith LC, Wiesmann DM and T Frankenberger** The world's most deprived: characteristics and causes of extreme poverty and hunger. 2020 Vision for Food, Agriculture, and the Environment. Discussion Paper, No. 43. Washington, D.C.: International Food Policy Research Institute (IFPRI), 2007: 3-29.

10. **Weinberger K and TA Lumpkin** Diversification into horticulture and poverty reduction: A research agenda. World Development, 2007; **35**: 1464–80.

11. **Yang RY and GB Keding** Nutritional contribution of important African vegetables. **In:** Shackleton CM, Pasquini MW, Drescher AW (Eds). African indigenous vegetables in urban agriculture. London, UK: Earthscan, 2009: 105-135.

12. **Chioma A, Obiora A and U Chukwuemeka** Does the African garden egg offer protection against experimentally induced ulcers? *Asian Pac. J. Trop. Med.* 2011; **4 (2)**: 163–66.

13. **WHO and FAO.** Fruit and vegetables for health: Report of a Joint FAO/WHO Workshop, 1–3 September 2004, Kobe, Japan. Geneva: WHO, 2005.

14. **Chagomoka T, Kamga R, Tenkouano A and M Mecozzi** Traditional vegetables: Recipes from Cameroon. Shanhua, Taiwan: AVRDC – The World Vegetable Center, 2014; 14 -779: 55.

15. **Keatinge JD, Chadha ML, Hughes Jd, Easdown WJ, Holmer RJ, Tenkouano A, Yang RY, Mavlyanova R, Neave S, Afari-Sefa V, Luther G, Ravishankar M, Ojiewo C, Belarmino M, Ebert A, Wang JF and L Lin** Vegetable gardens and their impact on the attainment of the Millennium Development Goals. *Biological Agriculture & Horticulture.* 2012; **28 (2)**: 71–85.

16. **Kamga A, Kouamé C, Tchindjang M, Chagomoka T and AW Drescher** Environmental impacts from overuse of chemical fertiliser and pesticides amongst market gardening in Bamenda Cameroon. *Revue Scientifique et Technique Forêt et Environnement du Bassin du Congo* 2013; **1**: 6–19.

17. **Drechsel P, Graefe S, Sonou M and OO Cofie** Informal irrigation in urban West Africa: An overview. International Water Management Institute 2006; IWMI Research Report 102. Available from: Available on http://www.ruaf.org/sites/default/files/Drechsel.pdf.

18. **Owusu-Boateng G and KK Amuzu** A survey of some critical issues in vegetable crops farming along River Oyansia in Opeibea and Dzorwulu, Accra-Ghana. *Glo. Adv. Res. J. Phys. Appl. Sci.* 2013; 2 (2): 024–031.

19. **Cobbina SJ, Kotochi MC, Korese JK and MO Akrong** Microbial contamination in vegetables at the farm gate due to irrigation with wastewater in the tamale metropolis of Northern Ghana. *J. Environ. Prot.* 2013; **4 (7)**: 676–82.

20. **Magigi W** Improving urban land governance with emphasis on integrating agriculture based livelihoods in spatial land use planning practise in Tanzania. Freiburg im Breisgau, Germany, 2008.

21. **Kessler A, Streiffeler F and E Obuobie** Women in urban agriculture in West Africa. *Urban Agriculture Magazine.* 2004; **12**: 16-1.

22. **Ghana Statistical Service.** Population by region, district, locality of residence, age groups and sex, 2010. Accra, Ghana: Ghana Statistical Service, 2012.

23. **Schlesinger J** Agriculture along the urban-rural continuum: A GIS-based analysis of spatio-temporal dynamics in two medium-sized African cities. Freiburg im Breisgau, Germany, 2013.

24. **Adam M** Definition and Boundaries of the Peri-urban Interface: Patterns in the Patchwork. **In:** Drechsel P, Kunze D (Eds). Waste Composting for Urban and Peri-urban Agriculture: Closing the Rural-Urban Nutrient Cycle in Sub-Saharan Africa. Wallingford: CABI, 2001; 193–208.

25. **Erenstein O, Moussa M, Oswald A and P Keijzer** Characterization of peri-urban lowland use along an ecological and market access gradient in West Africa. Abidjan, Cote d'Ivoire. West Africa Rice Development Association (WARDA) –The Africa Rice Center. 2004.

26. **Iaquinta D and A Drescher** Defining the peri-urban: rural-urban linkages and institutional connections (Land Reform, Land Settlement and Cooperatives), Reforme Agraire, Colonisation et Cooperatives Agricoles. Reforma Agraria, Colonizacion y Cooperativas. 0251-1894. FAO, 2000; **2 (8-26).**

27. **FAO.** Guidelines for measuring household and individual dietary diversity. [Rome]: Food and Agriculture Organization of the United Nations, 2011.

28. **Kabunga N, Ghosh S and JK Griffiths** Can smallholder fruit and vegetable production systems improve household food security and nutritional status of women? Evidence from rural Uganda. Washington D.C: International Food Policy Research Institute (IFPRI), 2014; 1-31.

29. **Kamga RT, Kouamé C, Atangana AR, Chagomoka T and R Ndango** Nutritional evaluation of five African indigenous vegetables. *J. Hort. Res.* 2013; **21(1)**: 99-106.

30. **FAO.** Home-based vegetable gardens and other strategies to overcome micronutrient malnutrition in developing countries. Rome, Italy: FAO, 2003.